FUNGICIDAL EFFECTIVENESS OF COMPOUNDS APPLIED TO LEATHER

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ABSTRACT

This report is a compilation of the test results on 126 compounds that have been screened as leather fungicides. The compounds were impregnated into leathers, and the mildew resistance of the leathers was observed by exposure (*a*) on a mycelial mat of *A. Niger* and (*b*) in a tropical room. Visual estimation of the amount of mildew growth on leathers containing known amounts of the fungicides was used as a measure of fungicidal effectiveness.

INTRODUCTION

A review by Turner *et al.* (5) in 1948 gave an extensive list of substances that up to that time had been suggested, used, or tested as antimicrobial agents for protection of hides, tan liquors, and finished leather. Grossmann and Stadler (3) in 1953 reported on the relative effectiveness of 24 materials, including a series of phenols, as antifungal agents for leather. The materials were applied to the leather in aqueous solutions. The last-named authors concluded that a really satisfactory leather fungicide had not been found.

During the past ten years studies of mildew growth on leathers have been pursued at the National Bureau of Standards in a program sponsored by the Quartermaster Corps. One phase of these studies has been the evaluation of new fungicides for leather. The first step in an evaluation has been to establish the effectiveness of the prospective fungicide when applied to finished leather. To be of value a fungicide must be able to prevent mildew growth when present in the leather in a reasonable concentration (less than 1%).

This has been used as the primary criterion for judging whether or not further development work on the compound is warranted.

A description of the Q. M. C. screening program for leather fungicides at NBS has been included in a previous publication (2). However, no previous compilation of all the materials screened has been presented. This report is such a compilation except that only the compounds with known chemical composition have been included. Materials with doubtful or unknown composition i.e., those designated only by trade names or code names, have been omitted. The results are given in Table I.

EXPLANATION OF TABLE I

The substances are listed alphabetically. Inversion of names has been used to arrange structurally related compounds together.

Most of the materials were directed to NBS by industry, research laboratories, or other government agencies through the Quartermaster Corps. In this manner numerous compounds were sent to NBS from the Prevention of Deterioration Center of the National Research Council after screening tests there had established that they were fungitoxic.

The solvents used for dissolving the various materials are given in the table, or a reference is given in the table to footnote 1 showing the solvent mixture used. Although some water-soluble materials were tested and are included in the table, water solubility is an undesirable property of a fungicide for finished leathers. Treatment with an aqueous solution adversely effects the physical appearance of many leathers and finished leather items, causing warping and deformation on subsequent drying. Aqueous solutions also have poor penetrating ability with highly greased leathers. The most serious objection to water-soluble leather fungicides, however, is that unless they are fixed in the leather in some manner they are easily leached out of the leather items if the latter come in contact with water during service. For these reasons most of the fungicides selected for screening at NBS were relatively insoluble in water.

The solvent mixture used whenever possible for preparation of the treatment solution was that denoted by solvent 1 in the table. This mixture consists of 10% cyclohexanone, 20% mineral oil or 10% each of mineral oil and neat's-foot oil, and 70% trichloroethylene or perchloroethylene. Whenever other solvents were used, it was because complete solubility could not be obtained with solvent 1.

The screening tests consisted of treating leather specimens with these solutions and observing the effects by testing the mildew resistance of the treated leathers, as will be described later. An important factor of such tests is the type of leather used, because all leathers are not equally susceptible to mildew growth. Vegetable-tanned leathers are generally more susceptible than leathers of other types of tannages. All results given are based on observations with a vegetable-tanned test leather. A vegetable-tanned sole leather crust was generally used. This leather contains less filler and oils than finished sole leather and is not compressed by rolling. It is very susceptible to mildew growth and was preferred in this work because its mildew susceptibility was found to be uniformly the same whenever a new supply had to be obtained. Other types of leathers are less satisfactory as test leathers in this respect.

Impregnation of the leather specimens with the desired percentages of the substance to be tested was accomplished by immersion of the specimens in solutions containing appropriate percentages of the substance. The percent deposition of the substance in the leather was calculated from the amount of solution absorbed and the solution concentration. The amount absorbed was determined by weighing the leather specimen before and immediately after treatment.

The majority of the substances were tested at concentrations in the leather no higher than 0.60% (based on air-dry-leather weight). 4-nitrophenol (*p*-nitrophenol), which has been used as the comparison standard for new fungicides, provides complete protection against mildew growth on leathers at a concentration of 0.30% under the most severe test conditions used (tropical room exposure, see below).

In order to be of value it has been assumed that a new fungicide would at least have to exhibit some inhibition of mildew growth at 0.60%. In a few cases concentrations higher than 0.60% were used.

The presence or absence of mildew growth, as well as estimation of the amount of mildew growth on specimens not rendered completely mildew-resistant, was determined by visual inspection. The details of the procedure for collection and treatment of test data were essentially as described previously (2). Unless both grain and flesh surfaces of the leather specimens were free from mildew, the treatment was not considered to have achieved prevention of mildew growth. However, mildew growth on edges, occurring occasionally even with the most effective treatments, was neglected.

In the table, code letters denote the ratings or relative mildew-preventive effectiveness of the substances estimated from (*a*) initial screening test and/or (*b*) tropical room exposure test. The meaning of the code letters is given in footnote 2 of the table.

The results shown in the table are based on series of tests involving at least three concentrations of each substance and two or more leather specimens for each concentration. The highest and lowest concentrations used were generally double and one-half the intermediary concentration, respectively.

The concentration intervals that were used are reflected in the ratings given in the table. However, it should be pointed out that a fungicide given a rating of E, for example, is not necessarily twice as effective as one given

a rating of G. This might be suggested by the percentages 0.30 and 0.60 associated with the respective ratings, but it should be remembered that these percentages are not necessarily the lowest effective concentrations for either fungicide.

Initial screening tests.—The untreated leather specimens were placed on mycelial mats of *Aspergillus niger* (ATCC 6275) and incubated for 7 days at 29°C. They were also tested for resistance against American Leather Chemists Association sand spore mixture (1) for 21 days at 29°C. These two tests are described in Methods 5021 and 5011, respectively, of Federal Specification KK-L-311a, January 19, 1953. The ratings given are based on the poorest performance shown in either test if the test results differed. These tests were used only in preliminary screening and are, therefore, called initial screening tests.

Tropical room exposure tests.—The treated leather specimens were stored for 5 weeks in the tropical room at the Engineering Center of the U. S. Army at Fort Belvoir, Virginia. The microflora and conditions of this room are maintained to give approximately the mildew-growing conditions that would prevail in a tropical jungle (2). This room has been made available for use in this work through the cooperation of the Engineering Center.

DISCUSSION

A previous study (2) has shown that the tropical room exposure test predicts quite correctly the performance of the fungicides under field exposure conditions at a Panama jungle site. Because of this and the convenient availability to this laboratory of the tropical room, the initial screening test is currently being omitted in our evaluation of new leather fungicides. However, the data given in Table I furnish an opportunity to bring out certain points regarding the two screening tests and the compounds tested. Both tests were scored on 85 of the compounds, and the results may be exhibited in the following tabulation:

		Tropical Room Rating			
		E	G	F	P
Initial Test Rating	E	6	8	4	1
	G	9	10	5	
	F	1	6	6	
	P		1	28	

The entries show the number of compounds receiving the various possible 16 combinations of ratings. In only two instances (compounds 38 and 57, Table I) did the initial test rate a compound less effective than did the tropical

room exposure test. For 49 compounds (6 +9 +6 +28) the test agreed, and for 34 compounds the tropical room exposure test indicated less effectiveness than the initial test.

It is clear that the tropical room exposure test is more severe than the initial test. A compound failing in the initial test can safely be rejected. A compound passing the initial test may not be effective in the tropical room exposure test, i. e., under the most severe mildew-growing conditions encountered by military leather items.

The tabulation just given also shows the relative rareness of compounds that are as effective as *p*-nitrophenol according to the tropical room exposure test. Only the seven following compounds, including *p*-nitrophenol, received the highest rating, E.

No.	*Compound*
32	bis (2-chloro-4-nitrophenyl) carbonate
58	1,4-naphthoquinone, 2,3-dichloro-
69	phenol, 2-chloro-4-nitro-
78	phenol, 4,6-dinitro-2 methyl-
79	phenol, 4,6-dinitro-3-methyl-
83	phenol, 4-nitro- (*p*-nitro-)
105	phenyl thiocyanate, 2,4-dinitro-

It should be repeated that the results reported in this paper pertain only to the effectiveness of the compounds in preventing mildew growth on leather under the specific conditions of exposure. Their practical usefulness depends, of course, on many additional factors such as cost, availability, and effect on human health and on leather. Such factors have not been investigated or considered in this evaluation, but they, rather than the mildew-preventive potency, may well dictate the choice. The potential usefulness of compounds rated G or even F therefore is not excluded.

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TABLE I

RESULTS OF SCREENING TESTS WITH 126 FUNGICIDAL MATERIALS ON CRUST VEGETABLE SOLE LEATHER

No.	Substance	Solvent[1]	Rating[2] Initial Screening Test	Rating[2] Tropical Room Exposure Test
1	Acetophenone, (2-chloro-) 3-nitro- $CH_2ClCOC_6H_4NO_2$	1	—	G
2	Ammonium, Alkylbenzyldimethyl—chloride $R(CH_3)_2ClNCH_2C_6H_5$	water	F	F
3	Ammonium, alkyl-(3,4-dichlorobenzyl)-dimethyl—chloride $R(CH_3)_2NClC_6H_3Cl_2$	"	P	P
4	Ammonium, benzylcetyl-dimethyl—chloride $C_{16}H_{33}(CH_3)_2NClCH_2C_6H_5$	"	P	P
5	Ammonium, cetyltrimethyl—bromide $C_{16}H_{33}NBr(CH_3)_3$	"	P	P
6	Ammonium, ethyldimethyl-9-octadecenyl—bromide $(CH_3)_2C_2H_5NBr(CH_2)_8CH:CH(CH_2)_7CH_3$	"	P	P
7	Benzene, nitro-2,3,5,6-tetrachloro- $NO_2C_6HCl_4$	2	—	P
8	Benzoic acid, 4-hydroxy-methyl ester $HOC_6H_4COOCH_3$	1	—	F
9	Benzoic acid, 4-hydroxy-ethyl ester	1	—	F
10	Benzoic acid, 4-hydroxy-, *n*-propyl ester	1	—	F
11	Benzoic acid, 4-hydroxy-, *n*-butyl ester	1	—	F
12	1,4-Benzoquinone,2,3,5,6-tetrochloro-(chloranil) $O:C_6Cl_4:O$	2	G	G
13	Benzothiazole, 5-chloro-2- mercapto-, benzyl pyridinium salt $ClC_6H_3NCSSN(CH)_4CHCH_2C_6H_5$	3	G	F

TABLE I—(CONTINUED)

No.	Substance	Solvent[1]	Rating[2] Initial Screening Test	Rating[2] Tropical Room Exposure Test
14	Benzothiazole, 5-chloro-2-mercapto-, cetyl dimethyl amine salt $ClC_6H_2NCSSNH(CH_3)_2C_{16}H_{33}$	3	G	F
15	Benzothiazole, 5-chloro-2-mercapto-beta-hydroxy-ethyl pyridinium salt $ClC_6H_3NCSSN(CH_4)CHCH_2CH_2OH$	water	P	P
16	Benzothiazole, 5-chloro-2-mercapto-, cetyl amine salt $ClC_6H_3NCSSNH_3C_{16}H_{33}$	3	F	P
17	Benzothiazole, 5-chloro-2-mercapto-, lauryl pyridinium salt $ClC_6H_3NCSSN(CH_4)CHC_{12}H_{25}$	water	P	P
18	Benzothiazole, 5-chloro-2-mercapto-, lauryl pyridinium salt in solution	unknown	P	—
19	Benzothiazole, 5-chloro-2-mercapto-, trimethylbenzyl amine salt $ClC_6H_3NCSSN(CH_3)_3CH_2C_6H_5$	3	F	P
20	Benzothiazole, 5-chloro-2-mercapto-, zinc salt $(ClC_6H_3NCSS-)_2Zn$	water	P	P
21	Benzothiazole, 2-mercapto- (Captax) C_6H_4NCSSH	2	—	P
22	Benzothiazole, 2-mercapto-, benzyl pyridinium salt $C_6H_4NCSSN(CH)_4CHCH_2C_6H_5$	3	G	F
23	Benzothiazole, 2-mercapto-, beta-hydroxyethyl pyridinium salt $C_6H_4NCSSN(CH)_4CHCH_2CH_2OH$	2	F	P

TABLE I—(CONTINUED)

No.	Substance	Solvent[1]	Rating[2] Initial Screening Test	Rating[2] Tropical Room Exposure Test
24	Benzothiazole, 2-mercapto-, cetyl amine salt $C_6H_4NCSSNH_3C_{16}H_{33}$	3	G	F
25	Benzothiazole, 2-mercapto-, dodecyl amine salt (in solution) $C_6H_4NCSSNH_3C_{12}H_{25}$	unknown	P	P
26	Benzothiazole, 2-mercapto-, monoethanol amine salt $C_6H_4NCSSNH_3CH_2CH_2OH$	3	P	P
27	Benzothiazole, 2-mercapto-, monoethanol amine salt (in solution)	unknown	P	P
28	Benzothiazole, 2-mercapto-, lauryl pyridinium salt $C_6H_4NCSSN(CH)_4CHC_{12}H_{25}$ (in solution)	unknown	G	P
29	2-Benzothiazolethione, 3-(anilinomethyl)- $C_6H_4SCSNCH_2NHC_6H_5$	2	F	F
30	Biphenyl, 4-nitro- $NO_2C_6H_4C_6H_5$	1	—	P
31	Bis-(5-chloro-2-hydroxy-phenyl) methane (G4) $CH_2(ClC_6H_3OH)_2$	1	F	F
32	Bis-(2-chloro-4-nitro-phenyl) carbonate $(ClC_6H_3NO_2)CO_2$	1	E	E
33	Bis-(4-nitrophenyl) carbonate $(C_6H_4NO_2)_2CO_3$	1	E	G
34	Bis-(4-nitrophenyl) ether $(C_6H_4NO_2)_2O$	1	—	P
35	Bis-(methylxanthyl) sulfide $(CH_3OCS_2)_2S$ (N-466)	1	E	F
36	Capric and caprylic acids, (mixture) capric acid $CH_3(CH_2)_8COOH$ caprylic acid $CH_3(CH_2)_6COOH$	1	P	P

TABLE I—(CONTINUED)

No.	Substance	Solvent[1]	Rating[2] Initial Screening Test	Rating[2] Tropical Room Exposure Test
37	Copper 3, 5-dinitro-o-cresylate[a] $(NO_2)_2C_6H_2CH_3O)_2Cu$	1	E	G
38	Copper 8-quinolinolate[a] (commercial formulation; 10% solubilized Cu-8 in castor oil fatty acids) $(C_9H_6NO)_2Cu$	toluene	P	F
39	Copper 8-quinolinolate[a] (commercial formulation; 10% solubilized Cu-8 in oleic acid)	oleic acid	F	F
40	Copper 8-quinolinolate[a] [commercial formulation, less than 1% Cu-8, 5% zinc naphthenate, and unknown waxes, solvent, resin, and driers (in solution)	unknown	P	P
41	Copper 8-quinolinolate[b] (commerical formulation; 10% solubilized Cu-8 in xylol)	toluene	G	G
42	Copper 8-quinolinolate[a] (resin dispersion)	water	G	F
43	Copper 3-phenyl salicylate[a] $(C_6H_5C_6H_3OHCO_2)_2Cu$	acetone	F	F
44	1-cyclopentene, 4-(dichloro methylene)-1,2-dichloro-3,5-dione- $CClCClCOC(CCl_2)CO$	2	—	P
45	1-cyclopentene, 4-(dichloro methylene)-hexachloro $CClCClCCl_2C(CCl_2)CCl_2$	2	—	P
46	1,4-hydroquinone, tetrachloro- $(OH)_2C_6Cl_4$	2	G	G
47	1,4-hydroquinone, tetrochloro-	sulfated neat's-foot oil	G	G
48	Isoquinolinium lauryl bromide $C_9H_7NBrC_{12}H_{25}$	water	P	P
49	Mercury tert-butyl mercaptide $(CH_3)_3CS)_2Hg$	benzene + 20% mineral oil	—	P
50	Mucochloric acid, benzoic ester $C_6H_5COOCH_2CCl{:}CClCOOH$	1[c]	—	F

TABLE I—(CONTINUED)

No.	Substance	Solvent[1]	Rating[2] Initial Screening Test	Rating[2] Tropical Room Exposure Test
51	Mucochloric acid, n-butyl ether $C_4H_9OCH_2CCl:CClCOOH$	"	—	P
52	Mucochloric anhydride $(OCHCCl:CClCO)_2O$	"	—	F
53	Mucochloric carbanilate $(C_6H_5)_2NCOOCH_2CCl:CClCOOH$	"	—	F
54	1-naphthol $C_{10}H_7OH$	1	G	F
55	2-naphthol $C_{10}H_7OH$	1	G	G
56	1-naphthol,2,3,4-trichloro- $C_{10}H_4Cl_3OH$	trichloro-ethylene	—	F
57	1,4-naphthoquinone, 2-amino-3-chloro $C_{10}H_4NH_2ClO_2$	cyclo-hexanone	F	G
58	1,4-naphthoquinone, 2,3-dichloro-[d] $C_{10}H_4Cl_2O_2$	xylene	E	E
59	1,4-naphthoquinone, 3-chloro-2-dimethylamino- $C_{10}H_4ClN(CH_3)_2O_2$	cyclo-hexanone	—	F
60	1,4-naphthoquinone, 3-chloro-2-ethylamino- $C_{10}H_4ClNHC_2H_5O_2$	"	G	G
61	Nitromethane, tris (hydroxymethyl)- $NO_2C(CH_2OH)_3$	trichloroethylene	P	P
62	4-pentene,2,3-dione-1,1,5-trichloro- $CHCl_2COCOCH:CHCl$	2	—	P
63	Phenanthrenequinone[e] $C_{14}H_8O_2$	aqueous bisulphate sol.	G	G
64	Phenol, 2-amino-4-chloro-	1	—	P
65	Phenol, 4-chloro-2-cyclohexyl- $HOC_6H_3ClCH(CH_2)_4CH_2$	1	F	—
66	Phenol, 4-chloro-3,5-dimethyl-	1	G	G
67	Phenol, 4-chloro-3-methyl-6-tert-butyl-	1	F	—
68	Phenol, 4-chloro-2-isopropyl-5-methyl- (*p*-chlorothymol)[f]	1	G	P
69	Phenol, 2-chloro-4-nitro-	1	E	E

TABLE I—(CONTINUED)

No.	Substance	Solvent[1]	Rating[2] Initial Screening Test	Rating[2] Tropical Room Exposure Test
70	Phenol, 4 & 6-chloro-2-phenyl- (mixture)	1	F	P
71	Phenol, 2,4-dichloro-3,5-dimethyl-	1	P	P
72	Phenol, 3,5-dimethyl-4-nitro-	1	E	F
73	Phenol, 2,6,dimethyl-4-thiocyano- $HOC_6H(CH_3)_2SCN$	1	G	F
74	Phenol, 3,5-dimethyl-4-thiocyano-	1	E	G
75	Phenol, 2,4-dinitro-6-isobutyl-	1	F	F
76	Phenol, 2,4-dinitro-6-isopropyl-	1	G	G
77	Phenol, 2,4-dinitro-6-isopropyl-3-methyl-[f]	1	G	P
78	Phenol, 4,6-dinitro-2-methyl-[g]	1	E	E
79	Phenol, 4,6-dinitro-3-methyl-[g]	1	—	E
80	Phenol, 3-ethyl-4-thiocyano-	1	E	G
81	Phenol, 2-methyl-4-thiocyano-	1	E	G
82	Phenol, 2-nitro-	1	P	P
83	Phenol, 4-nitro-	1	E	E
84	Phenol, 4-nitro-, methyl ether $CH_3OC_6H_4NO_2$	1	—	P
85	Phenol, 4-nitro-tetrachloro-	2	—	G
86	Phenol, 4-nitro-tetrachloro-, acetic acid ester $CH_3CO_2C_6Cl_4NO_2$	2	—	F
87	Phenol, 4-nitro-tetrachloro-, methyl ether	2	—	P
88	Phenol, pentachloro-sodium salt-[h]	1	—	G
89	Phenol, pentachloro-, phenoxy-acetic acid ester $C_6Cl_5O_2CCH_2OC_6H_5$	2	G	F
90	Phenol, 2 phenyl-	1	G	P
91	Phenol, 2 phenyl-, tetradecyl-amine salt $C_6H_5C_6H_4OH.NH_2(CH_2)_{12}CH_3$	1	E	F
92	Phenol, 2,3,5,6-tetrachloro-	2	—	P
93	Phenol, 2,3,5,6-tetrachloro-, n-butyl ether	2	—	P
94	Phenol, tetrachloro-, cocoanut amine salt	trichloro-ethylene	—	P

TABLE I—(CONTINUED)

No.	Substance	Solvent[1]	Rating[2] Initial Screening Test	Rating[2] Tropical Room Exposure Test
95	Phenol, 2,3,5,6-tetrachloro-, ethyl ether	2	—	P
96	Phenol, 2,3,5,6-tetrachloro-, methyl ether	2	—	P
97	Phenol, tetrachloro-, propionic acid ester	1	P	P
98	Phenol, 2,3,4,6-tetrachloro-sodium salt[h]	1	F	—
99	Phenol, 4,thiocyano- HOC_6H_4SCN	1	E	G
100	Phenol, 2,4,5-trichloro-, sodium salt[h]	1	—	F
101	Phenol, 2,4,5-trichloro-, acetic acid ester	1[c]	P	P
102	Phthalic acid, dimethyl-ester $C_6H_4(CO_2CH_3)_2$	1	P	P
103	Phthalimide, N-(trichloro-methylthio)-1,2,3,6 tetrahydro-[i] $C_9H_8O_2NSCCl_3$	1	E	G
104	Phenyl ether, 4-nitrophenyl- $NO_2C_6H_4OC_6H_5$	1	—	P
105	Phenyl thiocyanate, 2,4-dinitro- $(NO_2)_2C_6H_3SCN$	1	E	E
106	Phosphonium, (3,4-dibenzyl phenyl) triphenyl-bromide $(C_6H_5CH_2)_2C_6H_3PBr(C_6H_5)_2$	alcohol	P	P
107	Propionic acid, propylene glycol mono ester $CH_3CH_2COOCH_2CH_2CH_2OH$ (in solution)	unknown	P	P
108	Pyrazole, 1-(4-chlorophenyl 3,5-dimethyl-4-nitroso- $ClC_6H_4NN{:}CCH_3C(NO){:}CCH_3$	2	G	F
109	5-pyrazolone, 3-methyl-4-oxime-1-phenyl- $C_6H_5NN{:}CCH_3C(NOH)CO$	2	G	F
110	Pyridine, 2-(4-chlorostyryl)- $C_5H_5NCH{:}CHC_6H_4Cl$	1	P	P
111	Pyridine, 4-(-4-chloro-styryl)- $C_5H_5NCH{:}CHC_6H_4Cl$	1	P	P

TABLE I—(CONTINUED)

No.	Substance	Solvent[1]	Rating[2] Initial Screening Test	Rating[2] Tropical Room Exposure Test
112	Pyridinium chloride, cetyl- $C_5H_5NClC_{16}H_{33}$	water	P	P
113	Quinoline, 8-hydroxy- HOC_9H_6N	1	P	P
114	Resorcinol, 4-chloro-[f] $C_6H_3(OH)_2Cl$	1	P	P
115	Resorcinol, 2-nitro- $C_6H_3(OH)_2NO_2$	1	E	F
116	Rhodanine, 3-(4-chloro-phenyl)-5-methyl- $SCSN(C_6H_4Cl)COCHCH_3$	1	P	—
117	Rhodanine, 3-(methoxy phenyl)[1] (N-149) $SCSN(C_6H_4OCH_3)COCH_2$	2[c]	P	—
118	Silicofluoride Na_2SiF_6	water	F	P
119	Succinic acid, alpha, beta-dichloro-, dimethyl ester $ClCHCOOCH_3$ | $ClCHCOOCH_3$[j]	1	G	P
120	Sulfonamide, p-toluene- $CH_3C_6H_4SO_2NH_2$	1	—	P
121	Thiadiazine-2-thione, 3,5-dimethyl, tetrahydro- $SCSNCH_3CH_2NCH_3CH_2$	1	P	—
122	Thianaphthene, 2-bromo-1-dioxide- $C_8H_6BrSO_2$	1	E	G
123	Thianaphthene, 2,3-dibromo-2,3-dihydro-1-dioxide- $C_8H_6Br_2SO_2$	1	E	P
124	2,4-thiazoledione, 3-phenyl- $SCON(C_6H_5)COCH_2$	2	P	P
125	Thiophenol, 4-chloro- HSC_6H_4Cl	cyclo-hexanone	P	P
126	*sym*-triazine, 2,4-dichloro-6-(2-chloroanilino)-(B622)[i] $C_6H_4ClNHCN{:}CClN{:}CHN{:}$	4	F	P

a Darkens leather
b Poor penetration
c 20% neat's-foot oil and no mineral oil were used in the solvent mixture because flocculation occured when mineral oil was used.
d Reportedly a skin irritant (4)
e Slightly sol. in acetone
f Volatile
g Yellow stain
h Neutralized with acetic acid
i Poor solubility
j Vesicant
[1] Solvents:
Solvent 1. 10% cyclohexanone
20% mineral oil or 10% each of mineral oil and neat's-foot oil
70% trichloroethylene or perchloroethylene
2. 30% cyclohexanone
20% mineral oil or 10% each of mineral oil and neat's-foot oil
50% trichloroethylene or perchloroethylene
3. 50% cyclohexanone
50% trichloroethylene or perchloroethylene
4. 40% cylcohexanone
20% mineral oil
20% ethanol
20% trichloroethylene

[2] Rating
E = Excellent. No more than 0.3 % of the fungicide in the leather was required for prevention of mildew growth.
G = Good. No more than 0.60 % of the fungicide in the leather was required for prevention of mildew growth.
F = Fair. (*a*) No more than 1.0 % of the fungicide was required for prevention of mildew growth, or (*b*) significant inhibition of mildew growth, compared with the growth on untreated leathers exposed under the same conditions, was obtained with 0.60 %.
P = Poor. (*a*) More than 1.0 % of the fungicide in the leather was required for prevention of mildew growth, or (*b*) no significant decrease of mildew growth was obtained with 0.60 %.

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